BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/08322 A1

(51) International Patent Classification[7]: H04B 7/005, H04Q 7/20

(21) International Application Number: PCT/SE00/01460

(22) International Filing Date: 7 July 2000 (07.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/359,859 26 July 1999 (26.07.1999) US

(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).

(72) Inventors: SIMONSSON, Arne; Sandåkersvägen 25, S-954 33 Gammelstad (SE). DESGAGNE, Michel; 6606 des Marronniers, St-Hubert, Quebec J3Y 8T4 (CA).

(74) Agent: NORIN, Klas; Ericsson Radio Systems AB, Common Patent Department, S-164 80 Stockholm (SE).

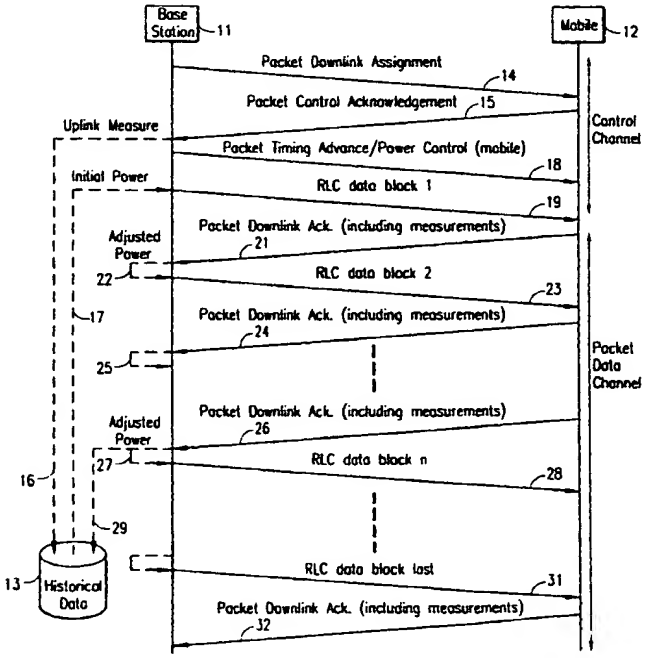
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

[Continued on next page]

(54) Title: INITIAL UPLINK AND DOWNLINK POWER LEVEL ASSIGNMENT IN A RADIO TELECOMMUNICATIONS NETWORK



(57) Abstract: A method of assigning initial uplink and downlink power levels for a transaction of a data package between a mobile station (12) and a base station (11) in a radio telecommunications network. A historical database (13) of signal strength measurements, interference measurements, and uplink and downlink power level settings in the network is maintained. To set downlink power, an uplink signal strength (16) of an initial access signal (15) sent from the mobile station to the base station is measured at the base station. The measured uplink signal strength (16) is sent to the historical database where it is correlated with an associated downlink power level setting. The correlated downlink power level setting (17) is sent to the base station where it is utilized as the initial downlink power level setting for a first transmission (19) from the base station to the mobile station. To set uplink power, the signal strength (42) of an initial packet channel request (41) on the control channel is sent to the historical database along with an interference measurement (43) on the packet date channel. An associated mobile station uplink power level setting (44) is retrieved from the database and sent to the mobile station where it is utilized for the first data transmission (46). A closed loop power control method may be utilized to adjust either the uplink or the downlink power level to an optimum level.

WO 01/08322 A1

— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INITIAL UPLINK AND DOWNLINK POWER LEVEL ASSIGNMENT IN A RADIO TELECOMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

Technical Field of the Invention

This invention relates to telecommunication systems and, more particularly, to a method of setting initial uplink and downlink power levels in a mobile station and a radio base station in a radio telecommunications network.

Description of Related Art

U.S. Patent No. 4,696,027 to Bonta (Bonta) discloses a two-way radio system which employs power control of a mobile station to provide a predetermined received signal strength at a radio base station following a handoff. During the locating function, Bonta measures the uplink signal strength of signals transmitted by the mobile station to the target base station, and after accounting for path loss, etc., the post-handoff power level of the mobile station is determined. Thus, the methodology utilized in Bonta is applicable to the uplink power level when a call is ongoing and there has been plenty of opportunity to make signal strength measurements for use in analyzing what mobile station power level is required in the target cell. However, Bonta does not teach or suggest a method of setting an initial uplink (mobile station to base station) or downlink (base station to mobile station) power level at times such as system access when multiple signal strength measurements have not been made.

In some existing Time Division Multiple Access (TDMA) radio telecommunications networks, a Base-Station Power Control (BSPC) function sets the initial downlink power level to its highest level when a mobile station first accesses the network and a call is being set up on a digital traffic channel. After uplink and downlink signal strength measurements have been reported, the BSPC function adjusts the downlink power level to a more optimum level. In most cases, this process ensures adequate downlink signal strength for call setup, but causes unnecessary peaks of energy in the downlink with a resultant increase in the interference level in the network. Therefore, some calls in co-channel cells may experience degraded radio

quality performance, or may even be disconnected.

In other existing radio telecommunications networks such as wideband Code Division Multiple Access (CDMA) systems, the initial downlink power level is set at its lowest level, and is then incrementally increased until the mobile station can receive it. After the initial downlink signal is sent to the mobile station, the system must wait for an acknowledgment from the MS. If an acknowledgment is not received, the downlink power is increased, and the signal is sent again. This process may be repeated several times before an acknowledgment is received from the mobile station. Thus, this approach reduces interference levels in the network, but requires additional time for call setup.

In order to overcome the disadvantage of existing solutions, it would be advantageous to have a method of assigning more optimum initial uplink and downlink power levels at system access on the control channel (for a circuit-switched call) or at acknowledgment on the packet channel (for a packet-switched call). Such a method would also provide a more efficient way to optimize initial power settings following handoff or at the beginning of a data transaction during an ongoing call. The present invention provides such a method.

SUMMARY OF THE INVENTION

In one aspect, the present invention is a method of assigning an initial downlink power level from a base station to a mobile station. The method assigns the initial downlink power level based on historical data. Rather than calculating the power level directly from signal strength measurements taken after the call has begun, the invention builds a historical database of signal strength measurements and path loss offsets in the system. These path loss offsets are then correlated with the downlink power used by the power control algorithm in the base station, and a statistical relationship between the two is determined. When it is time to assign the initial downlink power, the uplink signal strength is measured, and then the downlink power corresponding to that measured signal strength is assigned. The method may be applied at initial system access or at intercell handoff, and is applicable to both circuit-switched calls and packet-switched data transactions.

In particular, the method of the present invention maintains a historical database of signal strength measurements and downlink power level settings in the telecommunication system. The uplink signal strength of an initial signal sent from the mobile station to the base station is measured at the base station. The measured uplink signal strength is sent to the historical database where it is correlated with an associated downlink power level setting. The correlated downlink power level setting is sent to the base station where it is utilized as the initial downlink power level setting for a first transmission from the base station to the mobile station. A closed loop power control method may then be used to adjust the downlink power level to achieve an optimum received signal strength at the mobile station. After the initial phase of the closed loop method, the historical database is updated by sending the adjusted downlink power level to the historical database, and associating the adjusted downlink power level setting with the uplink signal strength of the initial signal sent from the mobile station to the base station.

In another aspect, the present invention is a method of assigning an initial downlink power level at intercell handoff between a target base station and a mobile station in a radio telecommunication system. The method includes the steps of building a historical database which correlates measurements of radio quality parameters with downlink power level settings, measuring at the target base station a radio quality parameter from an initial signal sent from the mobile station to the target base station, and sending the measured radio quality parameter to the historical database. The method also includes correlating in the historical database the measured radio quality parameter with an associated downlink power level setting, sending the correlated downlink power level setting to the target base station, and utilizing the correlated downlink power level setting as the initial downlink power level setting for a first transmission from the target base station to the mobile station.

In yet another aspect, the present invention is method of assigning an initial uplink power level from a mobile station to a base station in a radio telecommunication system. The method includes building a historical database which correlates measurements of radio quality parameters such as signal strength and interference measurements with uplink mobile station power level settings. The radio

quality parameters are then measured at the base station. For example, the method may measure a signal strength of an initial access signal sent from the mobile station to the base station, assign a packet data channel to the mobile station, and then measure an interference level on the assigned packet data channel. This is followed by sending the measured parameters to the historical database, correlating the measured parameters with an optimum uplink mobile station power level setting, sending the correlated optimum uplink mobile station power level setting to the mobile station, and utilizing the correlated optimum uplink power level setting as the initial mobile station power level setting for a first data transmission from the mobile station to the base station.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and its numerous objects and advantages will become more apparent to those skilled in the art by reference to the following drawing, in conjunction with the accompanying specification, in which:

FIG. 1 is a signal flow diagram illustrating how the method of the present invention is utilized with the General Packet Radio Service (GPRS) and the Global System for Mobile Communications (GSM) to determine an initial downlink power level and to maintain the historical database;

FIG. 2 is a signal flow diagram illustrating how the method of the present invention is utilized with GPRS and GSM to determine an initial uplink power level and to maintain the historical database; and

FIG. 3 is an exemplary data structure for the historical database.

DETAILED DESCRIPTION OF EMBODIMENTS

The present invention is a method of assigning initial uplink and downlink power levels at times such as system access when multiple signal strength measurements between a mobile station and a base station have not been made. The invention assigns the initial power levels based on historical data. Rather than calculating a power level directly from signal strength measurements taken after the call has begun, the invention builds a historical database of signal strength

measurements and path loss offsets in the system. These path loss offsets are then correlated, for example, with the downlink power used by the power control algorithm in the base station, and a statistical relationship between the two is determined. When it is time to assign the initial downlink power, the uplink path loss is estimated, and then the downlink power corresponding to that path loss is assigned.

In a typical scenario in which initial downlink power is to be determined, a speech cell exists, and it is desired to begin the access at a near-optimum power level. The system may know only a single uplink signal strength measurement. The needed downlink power must be calculated from that single uplink measurement. A classical approach is to establish some fixed offset. To do so, however, the system must calculate path losses using a number of varying parameters which are not known. In addition, the uplink control signaling may be of very short duration, resulting in an unreliable measurement. Also, if interference is present, signal strength is not a good measure of radio quality.

Alternatively, if the cell is programmed to learn its environment, historical uplink and downlink path loss information can be stored as historical data. This historical data can then be associated with uplink signal strength measurements. Then, when a mobile station accesses the network, its uplink signal strength is measured, and the system can select a near-optimum initial uplink or downlink power level. A historical database may be built for each cell, transceiver, or mobile station type, depending on the level of accuracy desired. The database may also be built for each mobile individual or data transaction. This method can be applied to system access as well as handoff and data packet transfer.

The present invention is useful for assigning initial power level in a variety of networks, and is particularly useful for packet data applications. For packet data being transmitted from the base station to the mobile station, the system may assign the initial downlink power based only on an uplink packet control acknowledgment. This saves additional signaling now utilized by the BSPC function. For packet data being transmitted from the mobile station to the base station, the system may assign an initial uplink power based on the signal strength of the packet channel request signal which the mobile station sends on the control channel, and an interference measurement on

the assigned packet data channel. The historical database correlates these measurements with an optimum initial mobile station power level for the data transmission.

In many cases, it is more important to make an accurate determination of the initial power level in packet data transmissions because packet data transmissions may be of shorter duration than typical circuit-switched voice calls. Thus, the period of time utilized by existing BSPC functions to determine an optimum uplink or downlink power level may equate to a large percentage of the total transmission. For example, in a speech call, at least 20-30 seconds may be spent in one cell, and the interference caused by the initial peak transmitter power lasts for only 1 or 2 seconds of that period. A packet transmission may only last a few seconds, and therefore using existing techniques, a larger percentage of the call may be utilized trying to find a good power level.

Other methods may also be used for initial power level assignment for packet data transactions. For example, a certain mobile station may have conducted a recent packet data transaction, and by retaining signal strength and power level information, the system can better estimate the initial power level required in a later transaction. During a packet data call, the mobile station requests packets or acknowledges packets on the uplink signal channel. These requests or acknowledgments may be very short bursts. The signal strength of these requests or acknowledgments is measured, and a relationship is then built between the signal strength measurements and the power that is currently being used to eventually derive an optimum power level for packet transmission.

Several radio quality parameters may be measured and stored in the historical database for later correlation. Then, at a later system access, pairs of parameters, or combinations of additional parameters may be utilized to determine a most likely best initial power level. Examples of available radio quality measurements that can be utilized for the historical database are:

- Signal strength of control signaling during access;
- Signal strength on the idle traffic channel, indicating interference;
- Energy-per-bit/Noise (Eb/No) or Carrier-to-Interference (C/I)

measurements;

- Bit errors, indicating radio quality (Eb/No or C/I); and
- Cell-load or sum of used power in a CDMA system, indicating interference.

Since uplink and downlink offsets are measured and compensated for, either uplink or downlink measurements can be used and correlated with the desired power. Therefore, uplink measurements can be utilized to set initial downlink power.

As noted above, the historical database can be built for each cell, transceiver, mobile station type, mobile individual, or data transaction. The database may be built on a per-cell basis to adapt to each cell radio environment, to measurement devices inaccuracy, and to the uplink/downlink link budget difference. The database may be built on a per-transceiver basis to adapt to equipment differences and to channel reuse/interference differences between channels. The database may be built on the basis of mobile station type in order to adapt to different mobile station design characteristics. The database may be built on a per-mobile individual basis to adapt to each mobile station. The database may be built on a per-data transaction basis to retain and reuse data gathered about a particular radio environment during a packet data association.

FIG. 1 is a signal flow diagram illustrating how the method of the present invention is utilized with the General Packet Radio Service (GPRS) and the Global System for Mobile Communications (GSM) to determine an initial downlink power level and to maintain the historical database. Illustrated in the figure are a base station 11, a mobile station 12, and a historical database 13 which stores signal strength measurements, path loss offsets, and associated power level settings in the network. The signal flow illustrates a Temporary Block Flow (TBF) process in which one data packet is sent downlink using GPRS. The data packet has been split into a number of Radio Link Control (RLC) blocks, each of which is four GSM bursts. This equates to between 22 and 54 bytes payload depending on channel coding.

When it is desired to transmit a packet to the mobile station 12, the base station 11 assigns a packet data channel and notifies the mobile station with a Packet Downlink Assignment signal 14 on the control channel. Upon receipt of this signal,

the mobile station sends a Packet Control Acknowledgment 15 as a response. The uplink signal strength of this acknowledgment is measured by the base station, and at 16, the measurement is passed to the historical database 13. The database utilizes the measured uplink signal strength and associated historical path loss offsets to select a near-optimum initial power level setting. At 17, the initial power level setting is returned to the base station. Meanwhile, the base station has sent a Packet Timing Advance/Power Control signal 18 to the mobile station on the control channel. The mobile station is then switched to the assigned packet data channel.

The first RLC data block 19 is then sent from the base station 11 to the mobile station 12 with the initial power based on the selected initial power level setting from the historical database 13. The mobile station receives the first RLC data block and measures the downlink signal strength and C/I. The mobile station then sends a Packet Downlink Acknowledgment signal 21 to the base station and includes the downlink measurement results. At 22, the base station filters the received downlink measurements, and uses a closed loop power control process to adjust the power level of the second RLC data block based on the received downlink measurements. The adjusted power level is calculated to result in a more optimum received signal strength at the mobile station. At 23, the second RLC data block is then sent from the base station to the mobile station at the adjusted power level. Once again, the mobile station receives the RLC data block and measures the downlink signal strength and C/I. The mobile station then sends a second Packet Downlink Acknowledgment signal 24 to the base station and includes the downlink measurements from the second RLC data block. At 25, the base station again adjusts the power level of the transmitted RLC data blocks based on the received downlink measurements.

This process continues until the closed loop power control has passed its initial phase, which is dependent on filter times. This is shown in FIG. 1 after "n" iterations where the mobile station 12 sends a Packet Downlink Acknowledgment signal 26 to the base station and includes the downlink measurement results from the n-1th RLC data block. At 27, the base station adjusts the power level of the nth RLC data block based on the received downlink measurements, and sends the data block to the mobile station at 28. At 29, the base station also passes the adjusted power level setting to the

historical database 13 which stores this value along with the uplink measurement recorded at step 16. This can be done with filters, a look-up table, or any other suitable method. As noted above, the value may be associated with one parameter or with others on a per-cell, per-data transfer, etc. basis.

The closed loop power control function may then continue until the last RLC data block is transmitted at 31, and the last Packet Downlink Acknowledgment signal 32 is sent to the base station with downlink signal strength and C/I measurements.

FIG. 2 is a signal flow diagram illustrating how the method of the present invention is utilized with GPRS and GSM to determine an initial uplink power level and to maintain the historical database. When it is desired to transmit a packet from the mobile station 12, the mobile station sends a Packet Channel Request signal 41 on the control channel to the base station 11. The base station measures the uplink signal strength of the signal and sends a signal strength measurement 42 to the historical database 13. The base station also assigns a packet data channel to the mobile station and measures the idle signal strength on the assigned channel as an interference measurement 43 which is also sent to the historical database. Alternatively, the interference may be continuously measured on all packet data channels and recorded in the historical database so that the information is readily available and does not delay allocation when requested.

The combination of signal strength of the Packet Channel Request signal 41 and interference on the assigned packet data channel 43 is then used in the historical database to look up an optimum initial mobile uplink power setting 44. The base station then sends a Packet Uplink Assignment signal 45 to the mobile station and includes the initial mobile uplink power setting.

Upon receipt of the Packet Uplink Assignment signal 45, the mobile station 12 sends a first RLC data block 46 to the base station 11 utilizing the initial mobile uplink power setting 44 from the historical database 13. The base station receives the first RLC data block, analyzes the quality of the received block, and uses a closed loop power control process at 47 to compute an adjusted uplink power setting for the mobile station. The adjusted uplink power setting is sent to the mobile station in a Packet Uplink Acknowledgment signal 48. The mobile station then uses the adjusted

uplink power setting to send the second RLC data block 49.

Once again, the base station receives the RLC data block (in this case RLC data block 2), analyzes the quality of the received block, and uses a closed loop power control process at 51 to compute an adjusted uplink power setting for the mobile station. The adjusted uplink power setting is sent to the mobile station in a Packet Uplink Acknowledgment signal 52.

This process continues until the closed loop power control has passed its initial phase, which is dependent on filter times. This is shown in FIG. 2 after "n" iterations where the mobile station 12 sends the nth RLC data block 53 to the base station 11. At 54, the base station computes an adjusted uplink power setting for the mobile station, and sends a Packet Uplink Acknowledgment signal 55 to the mobile station with the adjusted power level setting. At 56, the base station also passes the adjusted power level setting to the historical database 13 which stores this value along with the uplink signal strength measurement 42 and the uplink interference measurement 43 previously recorded. This can be done with filters, a look-up table, or any other suitable method.

The closed loop power control function may then continue until the last RLC data block 57 is transmitted from the mobile station 12, and the last Packet Uplink Acknowledgment signal 58 is sent from the base station 11.

FIG. 3 is an exemplary data structure for the historical database 13 in which the database is built for each cell 61. As noted above, the historical database may be built for each cell, transceiver, or mobile station type, depending on the level of accuracy desired. The database may also be built for each mobile individual or data transaction. Essentially, a database can be built for each entity which has individual behavior for initial data, and for which enough data can be collected. In each database, a probability density function (PDF) is built for each combination of measurement values. In this example, the combination of signal strength measurements 62 and interference measurements 63 results in a PDF 64 for each combination 65. The values can be rounded and truncated to limit the size of the database.

The PDF may be programmed in several ways to identify a power level setting associated with the signal strength/interference combination. For example, the PDF

may identify the most common resulting adjusted power level computed by the closed loop power control function and reported to the historical database. Alternatively, the PDF may identify a median value rather than the most common power level setting.

It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. While the method shown and described has been characterized as being preferred, it will be readily apparent that various changes and modifications could be made therein without departing from the scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A method of assigning an initial downlink power level from a base station to a mobile station in a radio telecommunication system, comprising the steps of:

building a historical database which correlates measurements of radio quality parameters with downlink power level settings;

measuring at the base station, a radio quality parameter from an initial signal sent from the mobile station to the base station;

sending the measured radio quality parameter to the historical database;

correlating in the historical database, the measured radio quality parameter with an associated downlink power level setting;

sending the correlated downlink power level setting to the base station; and

utilizing the correlated downlink power level setting as the initial downlink power level setting for a first transmission from the base station to the mobile station.

2. The method of assigning an initial downlink power level of claim 1 wherein the step of building a historical database includes building a historical database in which measurements are grouped for each transceiver in the base station.

3. The method of assigning an initial downlink power level of claim 1 wherein the step of building a historical database includes building a historical database in which measurements are grouped for each cell in the system.

4. The method of assigning an initial downlink power level of claim 1 wherein the step of building a historical database includes building a historical database in which measurements are grouped for each mobile station type operating in the system

5. The method of assigning an initial downlink power level of claim 1 wherein the step of building a historical database includes building a historical

database in which measurements are grouped for each mobile individual in the system.

6. The method of assigning an initial downlink power level of claim 1 wherein the step of building a historical database includes building a historical database in which measurements are grouped for each data transaction conducted in the system.

7. The method of assigning an initial downlink power level of claim 1 wherein the measured radio quality parameter is selected from a group consisting of:

an uplink signal strength of an initial access signal sent from the mobile station to the base station;

signal strength of control signaling during access;

signal strength on an idle traffic channel;

Energy-per-bit/Noise (Eb/No) measurements;

Carrier-to-Interference (C/I) ratio measurements;

bit errors;

cell-load in the system; and

sum of used power in the system.

8. The method of assigning an initial downlink power level of claim 1 further comprising a closed loop power control step, the closed loop step including:

measuring at the mobile station, at least one radio quality parameter of a transmission from the base station;

sending the measured radio quality parameter from the mobile station to the base station; and

adjusting the downlink power level at the base station to a more optimum level.

9. The method of assigning an initial downlink power level of claim 8 further comprising the step of updating the historical database, the updating step including:

sending the adjusted downlink power level to the historical database; and

associating the adjusted downlink power level setting with the uplink signal

strength of the initial signal sent from the mobile station to the base station.

10. The method of assigning an initial downlink power level of claim 9 wherein the updating step is performed after a number of iterations in which the received radio quality parameter is measured at the mobile station, the received radio quality measurements are reported to the base station, and the downlink power level is adjusted to a more optimum level.

11. The method of assigning an initial downlink power level of claim 10 wherein the number of iterations is determined when the closed loop power control step has passed its initial phase, as determined by filter times.

12. The method of assigning an initial downlink power level of claim 1 wherein the step of measuring at the base station, a radio quality parameter from an initial signal sent from the mobile station to the base station includes measuring the signal strength of control signaling at initial system access on a control channel for a circuit-switched call.

13. The method of assigning an initial downlink power level of claim 1 wherein the initial downlink power level is being set at intercell handoff of the mobile station from a serving base station to a target base station, and the step of measuring at the base station, a radio quality parameter from an initial signal sent from the mobile station to the base station includes measuring at the target base station, a radio quality parameter from an initial signal sent from the mobile station to the target base station.

14. The method of assigning an initial downlink power level of claim 1 wherein the initial downlink power level is being set for a transaction of a data package between the base station and the mobile station, and the step of building a historical database includes storing in the historical database, measurements of radio quality parameters and power level information from previous data package transactions between the base station and the mobile station.

15. The method of assigning an initial downlink power level of claim 14 wherein the step of measuring at the base station, a radio quality parameter from an initial signal sent from the mobile station to the base station includes measuring the signal strength of control signaling at packet control acknowledgment on a packet channel.

16. A method of assigning an initial downlink power level from a base station to a mobile station in a radio telecommunication system, comprising the steps of:

building a historical database which correlates measurements of radio quality parameters with downlink power level settings;

measuring at the mobile station, a radio quality parameter from an initial signal sent from the base station to the mobile station;

sending the measured radio quality parameter to the historical database;

correlating in the historical database, the measured radio quality parameter with an associated downlink power level setting;

sending the correlated downlink power level setting to the base station; and

utilizing the correlated downlink power level setting as the initial downlink power level setting for a first transmission from the base station to the mobile station.

17. The method of assigning an initial downlink power level of claim 16 wherein the measured radio quality parameter is selected from a group consisting of:

an uplink signal strength of an initial access signal sent from the mobile station to the base station;

signal strength of control signaling during access;

signal strength on an idle traffic channel;

Energy-per-bit/Noise (Eb/No) measurements;

Carrier-to-Interference (C/I) ratio measurements; and

bit errors.

18. The method of assigning an initial downlink power level of claim 16

wherein the step of measuring at the mobile station, a radio quality parameter from an initial signal sent from the base station to the mobile station includes measuring the signal strength of control signaling at initial system access on a control channel for a circuit-switched call.

19. The method of assigning an initial downlink power level of claim 16 wherein the initial downlink power level is being set at intercell handoff of the mobile station from a serving base station to a target base station, and the step of measuring at the mobile station, a radio quality parameter from an initial signal sent from the base station to the mobile station includes measuring at the mobile station, a radio quality parameter from an initial signal sent from the target base station to the mobile station.

20. The method of assigning an initial downlink power level of claim 16 wherein the initial downlink power level is being set for a transaction of a data package between the base station and the mobile station, and the step of building a historical database includes storing in the historical database, measurements of radio quality parameters and power level information from previous data package transactions between the base station and the mobile station.

21. A method of assigning an initial uplink power level from a mobile station to a base station in a radio telecommunication system, comprising the steps of:

building a historical database which correlates measurements of radio quality parameters with optimum uplink mobile station power level settings;

measuring at the base station, at least one radio quality parameter from signals sent from the mobile station to the base station;

sending the measured radio quality parameter to the historical database;

correlating in the historical database, the measured radio quality parameter with an optimum uplink mobile station power level setting;

sending the correlated optimum uplink power level setting to the mobile station; and

utilizing the correlated optimum uplink power level setting as the initial mobile

station power level setting for a first transmission from the mobile station to the base station.

22. The method of assigning an initial uplink power level of claim 21 wherein the measured radio quality parameter is selected from a group consisting of:

an uplink signal strength of an initial access signal sent from the mobile station to the base station;

signal strength of control signaling during access;

signal strength on an idle traffic channel;

Energy-per-bit/Noise (Eb/No) measurements;

Carrier-to-Interference (C/I) ratio measurements;

bit errors;

cell-load in the system; and

sum of used power in the system.

23. The method of assigning an initial uplink power level of claim 21 wherein the transmission from the mobile station to the base station is a data transmission, and the step of measuring at least one radio quality parameter from signals sent from the mobile station to the base station includes:

measuring at the base station, a signal strength of an initial access signal sent from the mobile station to the base station on a control channel; and

measuring at the base station, an interference level on an assigned packet data channel.

24. The method of assigning an initial uplink power level of claim 21 further comprising a closed loop power control step, the closed loop step including:

measuring at the base station, at least one radio quality parameter of the first data transmission from the mobile station;

utilizing the measured radio quality parameter to compute an adjusted mobile station power level; and

sending the adjusted mobile station power level from the base station to the

mobile station.

25. The method of assigning an initial uplink power level of claim 21 wherein the step of building a historical database includes the steps of:

establishing an association of signal strength measurements on a control channel and interference measurements on a packet data channel; and

building a probability density function (PDF) of uplink power level settings for each combination of measured control channel signal strength and packet data channel interference.

26. The method of assigning an initial uplink power level of claim 25 wherein the PDF identifies the most common resulting adjusted mobile station power level computed by the closed loop power control step.

27. The method of assigning an initial uplink power level of claim 25 wherein the PDF identifies a median adjusted mobile station power level computed by the closed loop power control step.

28. The method of assigning an initial uplink power level of claim 21 wherein the step of measuring at the base station, at least one radio quality parameter from a signals sent from the mobile station to the base station includes measuring the signal strength of control signaling at initial system access on a control channel for a circuit-switched call.

29. The method of assigning an initial uplink power level of claim 21 wherein the initial uplink power level is being set at intercell handoff of the mobile station from a serving base station to a target base station, and the step of measuring at the base station, at least one radio quality parameter from signals sent from the mobile station to the base station includes measuring at the target base station, a radio quality parameter from an initial signal sent from the mobile station to the target base station.

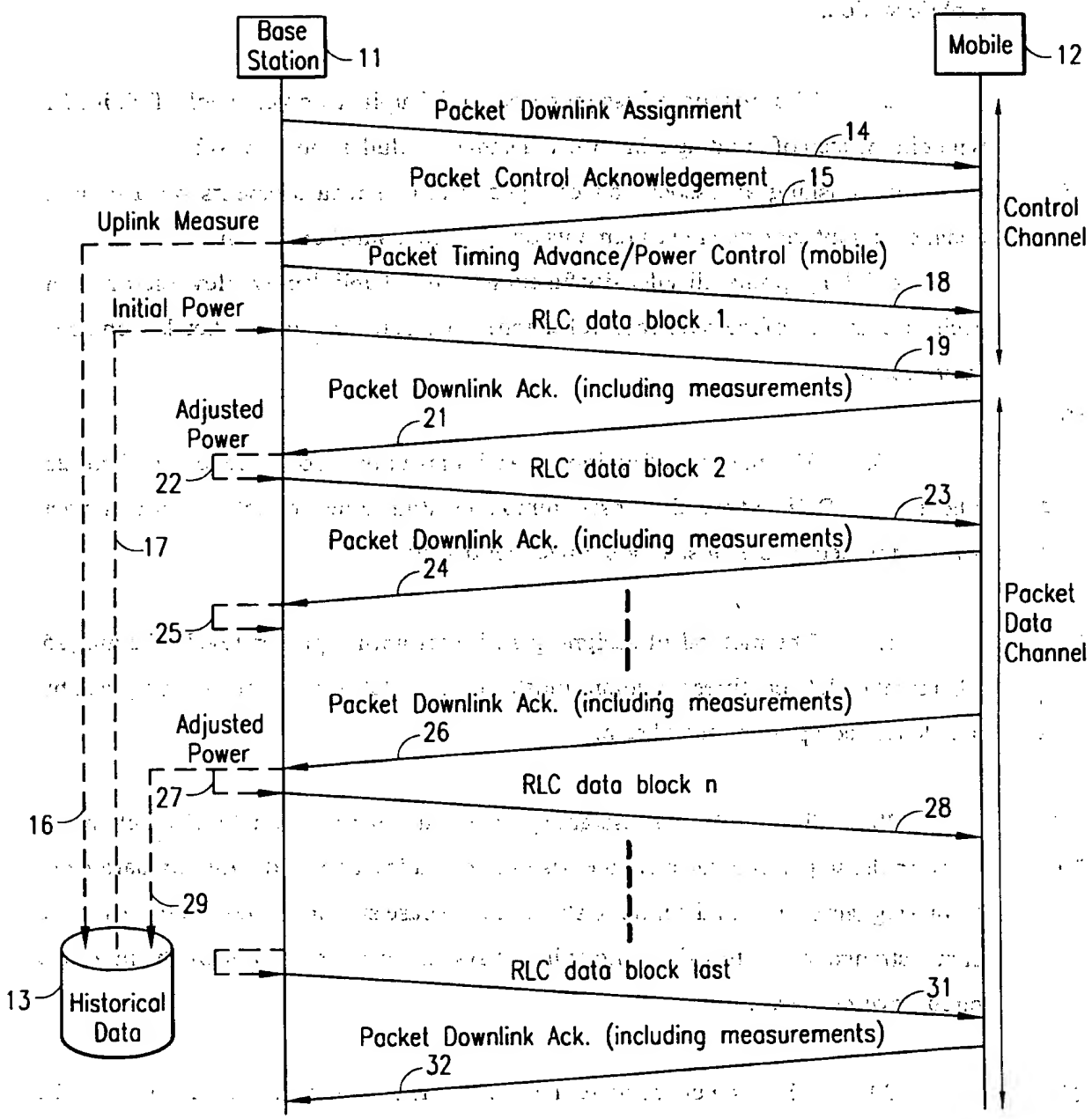

Base Station
11
Mobile
12
Packet Downlink Assignment
14
Packet Control Acknowledgement
15
Control Channel
Uplink Measure
Packet Timing Advance/Power Control (mobile)
18
Initial Power
RLC data block 1
19
Packet Downlink Ack. (including measurements)
Adjusted Power
21
22
RLC data block 2
23
Packet Downlink Ack. (including measurements)
17
24
25
Packet Data Channel
Packet Downlink Ack. (including measurements)
Adjusted Power
26
27
RLC data block n
28
16
29
RLC data block last
31
13
Historical Data
Packet Downlink Ack. (including measurements)
32

FIG. 1

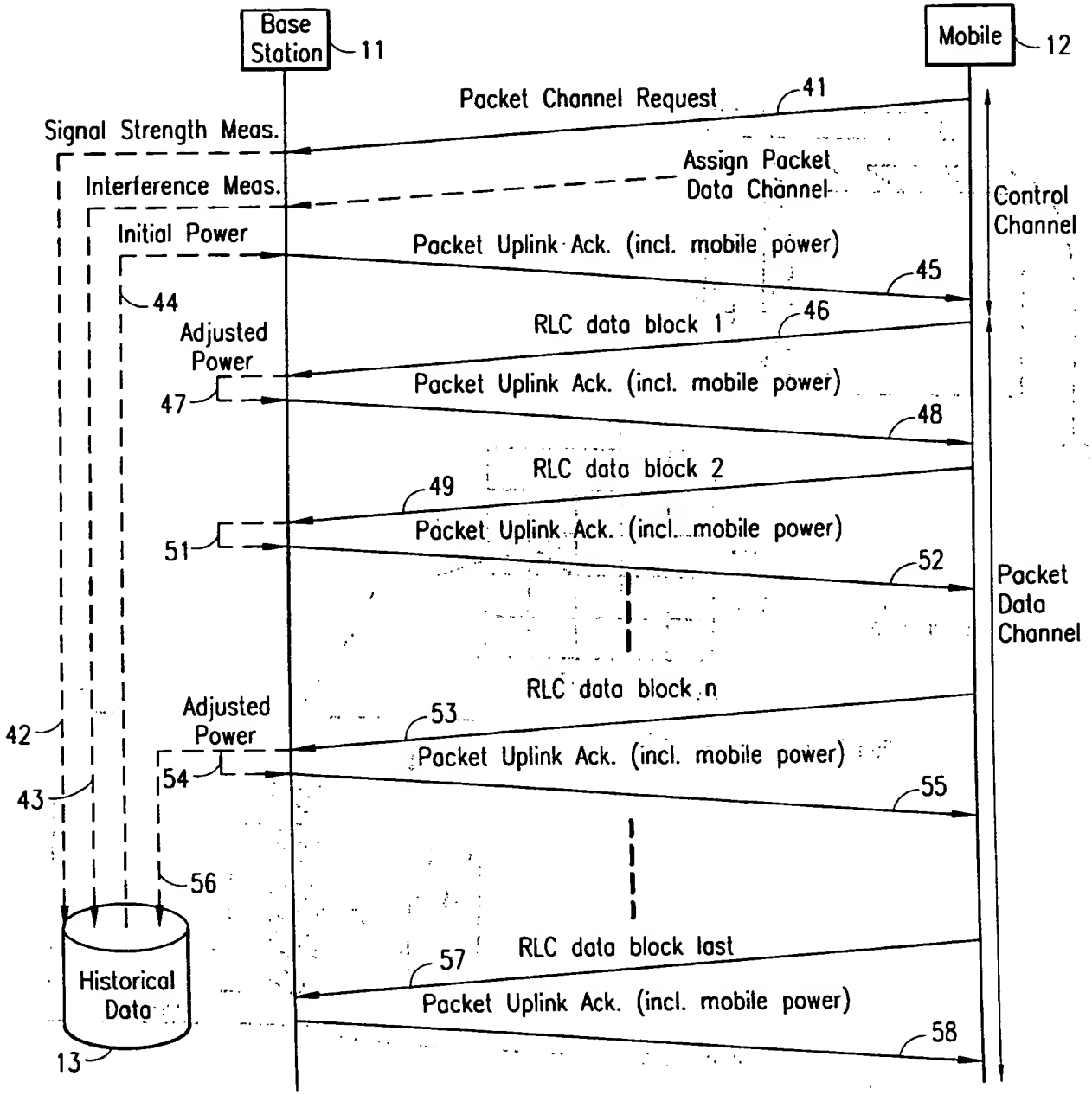

Base Station
11
Mobile
12
Packet Channel Request
41
Signal Strength Meas.
Assign Packet Data Channel
Interference Meas.
Control Channel
Initial Power
Packet Uplink Ack. (incl. mobile power)
45
44
Adjusted Power
RLC data block 1
46
Packet Uplink Ack. (incl. mobile power)
47
48
RLC data block 2
49
Packet Uplink Ack. (incl. mobile power)
51
52
Packet Data Channel
RLC data block n
Adjusted Power
53
42
Packet Uplink Ack. (incl. mobile power)
54
55
43
56
RLC data block last
57
Historical Data
Packet Uplink Ack. (incl. mobile power)
58
13

FIG. 2

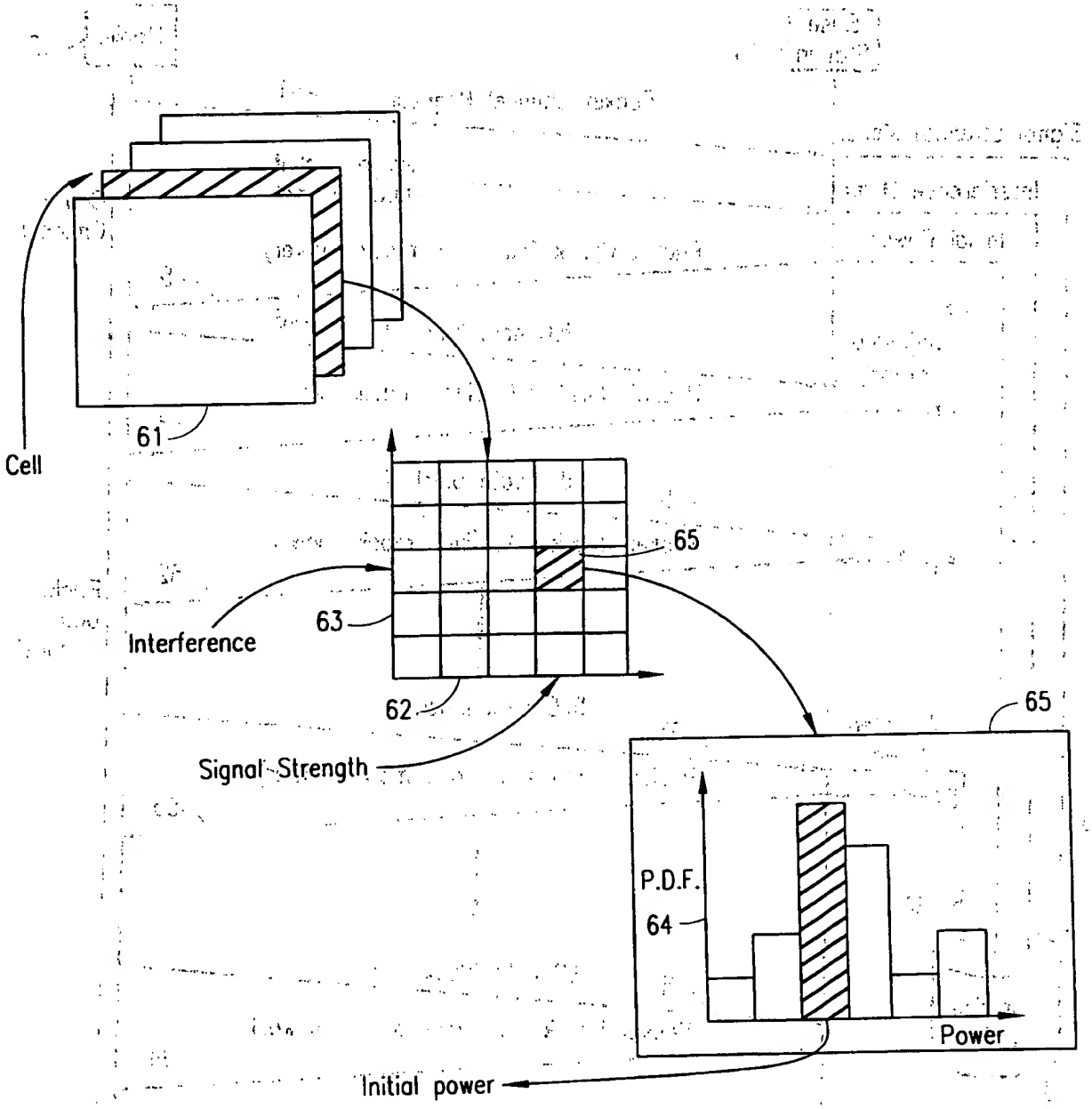

Cell
61
65
63
Interference
62
Signal Strength
65
P.D.F.
64
Power
Initial power

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01460

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/005, H04Q 7/20
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9934531 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 8 July 1999 (08.07.99), page 2, line 24 - page 4, line 24	1-29
A	WO 9849785 A1 (QUALCOMM INCORPORATED), 5 November 1998 (05.11.98), page 6, line 8 - page 8, line 26	1-29
A	WO 9406217 A1 (MILLICOM HOLDINGS (UK)), 17 March 1994 (17.03.94), page 2, line 16 - page 6, line 37	1-29

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 2000	11 12 2000

Name and mailing address of the International Searching Authority
European Patent Office P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel(+31-70)340-2040, Tx 31 651 epo nl,
Fax(+31-70)340-3016

Authorized officer
Antonio Farieta/mj
Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01460

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5873028 A (ETSUHIRO NAKANO ET AL), 16 February 1999 (16.02.99), column 2, line 34 - column 3, line 51 --	1-29
A	US 5884147 A (DOUGLAS O. REUDINK ET AL), 16 March 1999 (16.03.99), column 2, line 39 - column 6, line 7 --	1-29

INTERNATIONAL SEARCH REPORT

Information on patent family members

03/10/00

International application No.
PCT/SE 00/01460

WO	9934531	A1	08/07/99	AU	2193199	A	19/07/99
WO	9849785	A1	05/11/98	AU	7099498	A	24/11/98
				CN	1254460	T	24/05/00
				EP	0978170	A	09/02/00
				NO	995180	A	22/12/99
				ZA	9803400	A	27/10/98
WO	9406217	A1	17/03/94	EP	0611498	A	24/08/94
				GB	9218876	D	00/00/00
US	5873028	A	16/02/99	CN	1054013	B	28/06/00
				CN	1123976	A	05/06/96
				EP	0709973	A	01/05/96
				JP	3014308	B	28/02/00
				JP	8181653	A	12/07/96
US	5884147	A	16/03/99	AU	1569597	A	28/07/97
				CA	2241971	A	10/07/97
				IL	125275	D	00/00/00
				WO	9724895	A	10/07/97